# OPTIMISTIC BIAS AND PRECAUTIONARY BEHAVIOR: A LONGITUDINAL STUDY OF COMPARATIVE VS. NON-COMPARATIVE RISK ESTIMATES

By

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People generally believe that they are more likely than others to experience positive events and less likely than others to experience negative events. This phenomenon is known as the optimistic bias (Weinstein, 1980). Although numerous studies have examined moderators of the optimistic bias, little is known about the behavioral consequences of the bias. Many researchers assume that the optimistic bias leads people to misperceive their vulnerability to risk, and thus to act as a barrier to the adoption of precautionary behavior. In the present longitudinal study, I examined whether college women's comparative and non-comparative risk estimates at Time 1 regarding the possibility of an unintended pregnancy were associated with contraceptive behavior reported at Time 2. The results revealed that (a) participant's comparative risk estimates were generally optimistically biased, (b) more

favorable non-comparative risk estimates were associated with greater precautionary behavior, (c) optimistic comparative risk estimates were not associated with precautionary behavior but were associated with less anxiety, (d) the relationship between non-comparative risk estimates and precautionary behavior was not driven by pre-existing differences in perceived control and behavioral intentions but was largely due to differences in past precautionary behavior, and (e) the relationship between comparative risk estimates and precautionary behavior does not depend on participants' level of dispositional optimism. This study suggests that the optimistic bias is not harmful, that comparative risk estimates may reflect anxiety, and that non-comparative risk estimates may reflect precautionary behavior.

# INTRODUCTION

People tend to view their futures through rose-colored glasses. For instance, people believe they are more likely than others to own their own home, travel to Europe, and enjoy their job after graduation and less likely than others to have a heart attack, get a divorce, and be injured in a car accident (Weinstein, 1980). Regardless of age, race, or religion, people are prone to the optimistic bias, the belief that they are less likely than others to experience negative events and more likely than others to experience positive events (Weinstein, 1987).

Given the robustness of this phenomenon, considerable research has addressed potential moderators of the optimistic bias. However, the behavioral consequences remain unclear. Many researchers assume that the optimistic bias leads people to misperceive their vulnerability to risk, thus acting as a barrier to the adoption of precautionary behavior (Weinstein, 1982). For instance, smokers who believe they are less likely than others to suffer from lung cancer may be less likely to adopt the appropriate precautionary behavior and quit smoking. Indeed, the majority of past research has demonstrated a negative relationship between the optimistic bias and the adoption of precautionary behavior (Burger & Burns, 1988; Davidson & Prkachin, 1997;

Dolinski, Gromski, & Zawiska, 1988; Gladis, Michela, Walter & Vaughan, 1996; Miller, Ashley, McHoskey & Gimbel, 1990; Sheer & Cline, 1994; Sparks, Shepherd, Wieringer & Zimmermann, 1995). Some research, however, has failed to replicate this relationship. A number of studies either fail to find any relationship at all between the optimistic bias and precautionary behavior or find a positive relationship (Segerstrom, McCarthy, Caskey, Gross & Jarvik, 1993; Taylor, Kemeny, Aspinwall, Schneider, Rodriguez, & Herbert, 1992; Van der Velde, Van der Pligt, & Hooykaas, 1994; Vaughan, 1993; Whitley & Hern, 1991). Thus, the nature of the relationship between the optimistic bias and precautionary behavior remains unclear.

Although many researchers believe that the optimistic bias or "illusion of invulnerability" causes people to misperceive their vulnerability to risk, ironically, more recent research indicates that people who are optimistically biased may accurately assess their personal risk (Taylor & Shepperd, 1998). First, research has shown that people tend to perceive their risk as less than that of others engaging in similar risk behavior, but perceive their risk as greater than that of others who do not engage in risk behavior (McCoy, et al., 1992; McKenna, Warburton, & Winwood, 1993; Segerstrom, et al., 1993; Steptoe, et al., 1995; Strecher, et al., 1995). For example, smokers perceive their risk of lung cancer as less than other smokers but greater than non-smokers. Second, other research demonstrates that the source of the optimistic bias may lie, in part, in the tendency to overestimate other's risk rather than underestimate one's own

risk (Burger & Burns, 1988; Rothman, Klein, & Weinstein, 1996; Taylor & Shepperd, 1998; Whitley & Hern, 1991; see Helweg-Larsen & Shepperd, 1999 for a review). Thus, the optimistic bias may be inappropriately termed the "illusion of invulnerability" because people may accurately view themselves as vulnerable, but view others simply as more vulnerable.

Furthermore, a limitation of the research examining the relationship between the optimistic bias and precautionary behavior is that it is largely correlational. Weinstein and Nicolich (1993) note that many researchers misinterpret the correlation between the optimistic bias and precautionary behavior as a causal relationship; that is, many researchers conclude that optimistic bias impacts future behavior. However, Weinstein and Nicolich observe that these two constructs are often measured concurrently and cannot imply causation. As a result, many researchers acknowledge the great need for longitudinal data on this topic (see also Weinstein & Klein, 1996). Although longitudinal designs are often difficult and time-consuming, they may represent an important way to assess the association between the optimistic bias and future precautionary behavior.

In addition, because much of the research regarding the relationship between the optimistic bias and precautionary behavior is correlational, the possibility exists that a larger, overarching variable may be responsible for this relationship. In fact, past research reveals that variables such as perceived control, sexual knowledge, personal experience, behavioral intentions and past

behavior are related to both the optimistic bias and the adoption of precautionary behavior (Alloy & Ahrens, 1987; Burger & Palmer, 1992; Gibbons, Gerrard, & Bushman, 1996; Scarr, 1973; Skogan, 1987; Taylor & Shepperd, 1998; Weinstein, 1980; 1982; 1987). Thus, any of these variables could account for the relationship between optimistic bias and precautionary behavior.

Finally, past research has operationalized perceived risk in two different ways. First, perceived risk can be assessed by asking people to estimate their personal risk for some future event. Second, most optimistic bias research operationalizes perceived risk by comparing personal risk estimates to a risk estimate made for an average other or target person. For this measure, a positive difference score reflects optimism and a negative difference score reflects pessimism. The first measure is a non-comparative risk estimate and the second measure is a comparative risk measure. Past researchers have assumed that a perceived invulnerabiity to risk, whether it is based on comparative or non-comparative risk judgements, will lead to a lack of precautionary behavior. However, it is possible that the two operations of perceived risk vary in their purpose and may relate differently to precautionary behavior.

In the present research, I conducted a three-month longitudinal study in which I investigated the relationship between college women's perceived risk regarding the possibility of an unintended pregnancy and future contraceptive behavior. I examined (a) whether comparative risk estimates were optimistically

biased, (b) whether comparative risk estimates regarding experiencing an unplanned pregnancy were positively or negatively associated with subsequent contraceptive use, (c) whether some larger, overarching psychological variable is responsible for the relationship between non-comparative risk estimates and future precautionary behavior, and (d) whether the relationship between comparative risk estimates and future precautionary behavior depends on participants' level of dispositional optimism.

First, as mentioned earlier, researchers have operationalized perceived risk in terms of both comparative and non-comparative risk estimates. It is possible that the two operations of perceived risk vary in their purpose and consequently, may relate differently to precautionary behavior. Comparative risk estimates may fulfill a self-serving purpose, such as reducing negative affect experienced in anticipation of a negative event. Thus, comparative risk estimates, rather than reflecting precautionary behavior patterns, may reflect a desire to avoid negative affect. However, non-comparative risk estimates may function to reflect precautionary behavior. Presuming that people are accurately perceiving their personal risk, non-comparative risk estimates should correlate negatively with precautionary behavior. Thus, based on how perceived risk is operationalized, researchers could make very different predictions about the relationship between risk estimates and precautionary behavior.

Second, the relationship between non-comparative risk estimates and precautionary behavior may be attributable to other psychological processes

such as sexual knowledge, past experience, perceived control, behavioral intentions, and past behavior. Past research demonstrates that these variables are associated with both perceived risk and precautionary behavior and may be responsible for their relationship.

Third, Davidson and Prkachin (1997) have demonstrated that comparative risk estimates interact with dispositional optimism to predict changes in precautionary behavior over time. Specifically, they found that people who scored relatively high on dispositional optimism and who perceived themselves at less risk than a target person at Time 1 showed the greatest decline in precautionary behavior by Time 2. Conversely, people who scored relatively high on dispositional optimism but who perceived themselves at greater risk than a target person at Time 1 showed the least decline in precautionary behavior by Time 2. Thus, another purpose of the present study was to conceptually replicate Davidson and Prkachin's (1997) research and examine whether the relationship between comparative risk estimates and future contraceptive behavior depends on level of dispositional optimism.

## REVIEW OF LITERATURE

### Conceptualizing the Optimistic Bias

The optimistic bias is defined as the tendency for people to believe that they are more likely to experience a positive event and less likely to experience a negative event than others (Weinstein, 1980, 1982, 1983). Past research demonstrates that people perceive themselves to be less vulnerable than others when assessing their risk for a variety of negative events including HIV, cancer, heart attacks, pneumonia, leukemia, alcoholism, venereal disease and car accidents (Bauman & Siegel, 1987; Harris & Guten, 1979; Kirscht, Haefner, Kegeles, & Rosenstock, 1966; Lang, 1980; Perloff, 1983; Weinstein, 1980; Weinstein, Grubb, & Vautier, 1986). In addition, people believe they are more likely to experience a variety of positive events such as traveling to Europe, getting a high paying job after graduation, having gifted children and owning their own home (Weinstein, 1980). Across a wide range of events people not only believe that good things will happen to them and bad things won't happen to them: they believe that their outcomes will be more positive than the outcomes of others.

Researchers have traditionally assessed the optimistic bias by demonstrating a group of people to be optimistic rather than any one individual.

The optimistic bias is seldom detectable in a single individual due to the difficulty associated with assessing an individual's actual likelihood of an event happening to them. However, when viewed in aggregate, the optimistic bias is more easily detectable. Suppose an entire group of people made the prediction that their likelihood of suffering from a heart attack was less than average. Under these circumstances, evidence for the optimistic bias is strong. It is statistically impossible for all members to have a less than average likelihood of suffering from a heart attack. Thus, an optimistic outlook can be conceived as biased, at the group level, because it is statistically impossible for all individuals of a group to be below average for a particular risk (Klein & Weinstein, 1996).

## Cognitive Sources of the Optimistic Bias

The optimistic bias may derive from either cognitive or motivational sources. Cognitive explanations revolve around how people process information. One cognitive explanation for the optimistic bias stems from people's tendency to be egocentrically biased. Specifically, people have difficulty adopting the perspective of others when not prompted specifically to do so (Jones & Nisbett, 1971; Ross, Green & House, 1977; Ross & Sicoly, 1977). For example, people may be aware of actions they engage in to produce a desired outcome because these actions are mentally available to them, however they may not be privy to the same information about other's actions. Regarding the optimistic bias, the egocentric bias can lead people to underestimate the precautionary behavior of others when assessing their personal risk (Weinstein

1980, 1983; Weinstein & Lachendro, 1982). For example, Weinstein (1980) asked participants to list factors that influenced their risk on a particular dimension. When a second group of participants read the list of factors generated by the first group, their optimistic bias declined, presumably in response to their realization that others are just as inclined as they are to take precautions.

A second cognitive explanation for the optimistic bias is that people possess a natural inclination to recall factors that reduce their risk rather than increase their risk (Weinstein 1982, 1983). When asked to list factors that contribute to their standing on a risk dimension, people demonstrate a tendency to selectively recall factors that decrease their risk more often than those that increase their risk. This may reflect an ignorance of factors that increase risk or a self-presentational bias. Weinstein (1983) attempted to reduce the effects of selective recall by having participants rate their standing on a list of known and suspected contributors to a particular disease. Under these pretenses, participants were forced to consider not only risk decreasing behaviors, but also risk increasing behaviors. However, when asked to consider both risk increasing and decreasing factors, participant's optimistic biases actually increased, perhaps supporting a self-presentational bias explanation.

The first two cognitive explanations for the optimistic bias may be best described by a reliance on the availability heuristic. A third explanation for the optimistic bias also involves a reliance on the representativeness heuristic or the

salience of a prototypical victim. Weinstein (1980) noted that the optimistic bias may be nothing more than people comparing themselves to an inappropriate target. Asking a person about his/her risk of heart disease may prompt cognitions about the typical heart disease sufferer (i.e. someone who smokes, has a high cholesterol diet, and do not exercise). This target person is likely to be someone who does nothing to improve his/her chances or even engages in counterproductive behavior.

Motivational Sources of the Optimistic Bias

A second source of the optimistic bias can be best described as motivational in nature. Motivational explanations include needs or desires that cause a person to act. One motivation that may contribute to the optimistic bias is the need for personal control. Langer (1975) proposed that people possess an illusion of control, leading them to exaggerate perceived control over certain events. The illusion of control may increase susceptibility to the optimistic bias by leading people to see themselves as better able to achieve positive outcomes and avoid negative outcomes that are not entirely under their control. In one study, students were asked to judge their likelihood of getting into a car accident as a passenger and as a driver. The results indicated that the students perceived a greater likelihood of getting into an accident when they were the passenger rather than the driver presumably due to an exaggerated sense of control in the driver condition. (McKenna, 1993).

Other motivational explanations for the optimistic bias include goals to protect self-esteem, project a positive social image, or reduce anxiety about risk (Gerrard, Gibbons, & Warner, 1991; Hoorens, 1993; Taylor, Kemeny, Aspinwall, Schneider, Rodriguez & Herbert, 1992; Weinstein, 1980, 1987). For example, ego-defensive mechanisms (i.e. denial) intended to reduce anxiety constitute one type of self-serving motivation that may contribute to unrealistic optimism (Kirscht et al., 1966). Conceiving serious versus not serious consequences would undoubtedly cause anxiety, unless participants were motivated to deny the seriousness of these consequences in order to avoid the ensuing anxiety. In one study, participants who perceived a disease as possessing serious consequences were more likely to rate their own chances of contracting it as less than average (Kirscht et al., 1966). Thus, participants may have been optimistic as a means of reducing anxiety.

Although the salience of a stereotypical victim has thus far been considered a cognitive contributor to the optimistic bias, it may also reflect a motivated attempt to perceive oneself favorably. People can fare far better by selectively comparing themselves to an unfortunate other than by comparing themselves to a fortunate other. People can achieve two goals by selectively choosing their comparison target. They can reduce anxiety and they can enhance personal control (Perloff, 1983; Wills, 1981a, 1981b). For example, if people assess their risk of heart disease by strategically choosing to compare themselves to an unhealthy target person, they could reduce their anxiety and

make themselves feel better. In addition, as a result of this comparison, people's sense of control over their outcomes may be enhanced.

Reducing the Optimistic Bias

A number of studies have addressed the difficulty in diminishing optimistic beliefs (Klein, 1996; Weinstein, 1980, 1983; Weinstein & Klein, 1995). Specifically, researchers have attempted to eliminate both the cognitive and motivational sources of the optimistic bias. However, research has indicated that attempts to reduce optimistic beliefs may not only fail to eliminate the bias but actually strengthen these beliefs. For instance, Weinstein and Klein (1995) conducted four studies aimed at reducing the optimistic bias. In the first study, participants were given a list of risk factors for certain health problems and then asked to rate their risk of experiencing these health problems in comparison to the average person. Presumably, making participants aware of the risk factors relevant to a particular health problem should help them rate their risk more accurately. However, their risk estimates were unaffected. In the second study, participants received information about a peer superior to them on a particular risk dimension. In theory, awareness of their inferiority should lead participants to abandon their optimism by reducing their ability to selectively attend to their strengths rather than their weaknesses. However, this manipulation not only failed to decrease the optimistic bias but actually increased the optimistic bias in some participants.

In the third study, participants were asked to form a mental image of a target at high or low risk of experiencing a weight problem. Presumably, picturing a mental image (as opposed to reading a description) of a target at low risk for developing a weight problem should reduce the optimistic bias because it disallows the use of the representativeness heuristic in making judgements. However, the results indicated that neither the mental image of the high nor low risk target affected the optimistic bias. In the fourth study, participants generated a list of either risk decreasing or risk increasing behaviors for a number of health problems and then estimated their risk and another's risk. Presumably, listing risk increasing behaviors should prime thoughts that decrease the optimistic bias and listing risk decreasing behaviors should prime thoughts that increase the optimistic bias. However, the manipulation failed to affect the optimistic bias. Despite the researchers' attempts to reduce the optimistic bias, participants maintained or strengthened their biases.

## Moderators of the Optimistic Bias

In addition to attempts to eliminate the cognitive and motivational sources of the optimistic bias, researchers have identified a number of variables that moderate the optimistic bias. In the present section, the moderators are divided into four areas pertaining to the situation, affective states, individual differences, or the target person.

Situational Factors

A number of situational factors moderate the optimistic bias including perceptions of control, proximity of feedback, event importance, and personal experience.

Perhaps the most studied moderator of the optimistic bias is perceived controllability of the event. Numerous studies report a positive relationship between perceptions of control and the optimistic bias such that the greater perceived control over the outcome of an event, the greater the optimistic bias (DeJoy, 1989; Drake, 1987; Harris & Middleton, 1994; McKenna, 1993; C. Weinstein 1988, N. Weinstein 1980, 1982, 1987; Whalen, Henker, O'Neil, Hollingshead, Holman & Moore, 1994). Despite the large number of studies supporting the relationship between perceived control and the optimistic bias, some studies have failed to replicate this effect. In fact, a small number of studies found little or no relationship between the perception of control and unrealistic optimism (Darvill & Johnson, 1991; Joseph et al., 1987; Van der Velde et al., 1992; Van der Velde et al., 1994). Studies that have not replicated the positive relationship between the optimistic bias and control have typically used participants at high risk for disease. Perhaps by persisting in high risk behaviors, these participants perceive little personal control over contracting disease. However, these participants continue to be optimistically biased, presumably due to a desire to reduce anxiety and not perceptions of control.

Proximity of feedback also moderates the optimistic bias. Specifically, people are particularly optimistic about events that are distant and increasingly more realistic or pessimistic as the event draws near. In one study, Shepperd, Oulette, and Fernandez (1996) found that students' estimates of their exam scores dropped from the moment they finished their exam to immediately before they received their exam results. Thus, as the "moment of truth" approached, confidence and optimistic beliefs waned (see also Gilovich, Kerr & Medvec, 1993; Taylor & Shepperd, 1998). Others note that temporal proximity may not affect optimistic beliefs under certain conditions. For instance, bungee jumpers did not abandon their optimistic bias from the time they arrived at the jump site to the moment they were strapped into the jumping harness (Middleton, Harris, & Surman, 1996). A number of explanations may account for the discrepant findings between the Shepperd and Middleton studies including differences in participants, anxiety and perceptions of control.

The perceived importance of an event may influence the optimistic bias. Most notably, how desirable we find an event and how much we wish to avoid it (i.e. how severe the consequences of the event) seem to impact the degree of optimistic beliefs. Presumably, the more desirable an event or severe its consequences, the more invested people are in a favorable outcome of that event. For instance, Weinstein (1980) found that the more desirable people rated positive life events and undesirable they rated negative life events, the more optimistically biased they were about the occurrence of those events.

Likewise, the more severe the consequences of an event, the greater the optimistic bias people report (Kirscht et al., 1966). However, other research failed to replicate the influence of severity on the optimistic bias or found the opposite effect (Taylor & Shepperd, 1998; van der Velde, Hooykaas, & van der Pligt, 1992; Weinstein, 1987; Weinstein, Sandman, & Roberts, 1991). One explanation for this discrepancy may lie in the likelihood that participants' optimistic beliefs will be challenged. For people who do not anticipate their beliefs will be challenged, greater severity may lead to greater optimism. However, for people who anticipate that their beliefs will be challenged (and perhaps disconfirmed), greater severity may lead to less optimism (see Taylor & Shepperd, 1998).

An individual's personal experience with an event may also moderate the optimistic bias. People who have personal experience with an event are more likely than people with little or no personal experience to believe that the event will occur in the future (Dolinski, Gromski, & Zawiska, 1988; van der Velde et al., 1992; Weinstein, 1980, 1982, 1987). People take the past to represent the future and mistakenly believe that if a negative event has not occurred in the past, then it is unlikely to occur in the future. However, if the unexpected negative event does occur, comparative optimism tends to decrease. For instance, Burger and Palmer (1992) found that three days after a major earthquake struck the area, California residents were optimistically biased about

a number of future life events but not about the likelihood of being seriously hurt in a natural disaster.

Affective States

Affective states such as depression, anxiety, and mood are related to the optimistic bias. Typically, research has demonstrated that the more negative the participants' affective state (i.e. depression, anxiety, or sad mood) the less optimistic bias they report (Alloy & Ahrens, 1987; Dewberry & Richardson, 1990; Dunning & Story, 1991; Pyszczynski, Holt, & Greenberg, 1987; Salovey & Birnbaum, 1989; Shepperd et al., 1996). Researchers have shown that adolescents displaying depressive symptoms are less optimistically biased than are adolescents not displaying depressive symptoms (Dalley, Bolocofsky & Karlin, 1994). In addition, the optimistic bias varies inversely with anxiety and mood such that greater anxiety and negative mood are associated with less optimistic bias (Dewberry, Ing, James, & Nixon, 1990; Welkenhuysen, Evers-Kiebooms, Decruyenaere & van den Berghe, 1996).

Individual Differences

Two other variables, age and culture, are suspected to moderate the optimistic bias. Regarding age, one might anticipate that, adolescents would possess a greater "illusion of invulnerability" than older adults presumably due to fewer experiences with negative outcomes or hazards. Although many researchers assumed that the optimistic bias declines with age, empirical evidence does not support this assumption (Strecher, Kreuter, & Kobrin, 1995;

Weinstein, 1987). In one study, Dejoy (1989) showed that an optimistic bias about one's driving skills only decreased marginally with age. In addition, older adults tended to be optimistically biased about their health status regardless of whether their health was good or failing (Staats, Heaphey, Miller, Partlo, Romine & Stubbs 1993). Others have found that teens are less optimistically biased than their parents on an number of health related activities (Cohn, MacFarlane, Yanez, & Imai, 1995). Thus, although some research indicates differences in optimism across age groups, all age groups show the optimistic bias.

Recently, researchers have questioned whether cultural differences influence the optimistic bias (Fontaine & Smith, 1995; Helweg-Larsen, 1994). The consistent finding is that people from Western cultures are more optimistic than people from Eastern cultures (Heine & Lehman, 1995). Specifically, one study showed that Canadians were more optimistically biased than the Japanese (Heine & Lehman, 1995). The authors proposed that the Japanese were not as motivated as the Canadians to self-enhance due to their collectivist upbringing. Also, Americans, perhaps because of a possible greater proclivity to enhance self-esteem, tend to show a greater degree of the optimistic bias than other Westerners (Helweg-Larsen, 1994).

Target

Finally, optimistic bias can be moderated by the closeness of the comparison target. Research has shown that when people compare their own likelihood of experiencing a negative event to a close other, their optimistic bias

is lower than when they compare their likelihood to that of the "average person" (Harris & Middleton, 1994; Hoorens & Buunk, 1993; Perloff & Fetzer, 1986; Zakay, 1984). Perloff and Fetzer (1986) noted people displayed less optimism when comparing themselves to a specific target such as a best friend or sibling than when instructed to compare themselves to a vague target such as "one of your friends". Thus, participants who were forced to compare themselves to a specific, close target had difficulty rating the close other as at different risk than themselves. However, when allowed to choose from "one of your friends", participants could protect themselves and choose a real or hypothetical other who was at greater risk or perceived as more vulnerable. More recently, researchers have noted that it is not the similarity or vividness of a specific target that influences the optimistic bias, but whether a person has had personal contact with an individuated target. Specifically, people are less biased when comparing themselves to a target with whom they have had personal contact than a target with whom they have not had personal contact (Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995).

## Is the Optimistic Bias Harmful or Beneficial?

Some researchers have argued, explicitly or implicitly, that the optimistic bias is problematic because it undermines precautionary behavior by reducing perceptions of vulnerability to risk (Weinstein, 1982, 1984, 1987). Many researchers believe that an accurate perception of risk is paramount to the adoption of precautionary behavior. Some evidence suggests that perceptions

of vulnerability are related positively to precautionary behavior such that the less vulnerable people feel to risk, the less they engage in precautionary behavior (e.g. Becker, Haefner, Kosl, Maiman, & Rosenstock, 1977, Cummings, Jette, Brock, & Haefner, 1977; Bauman & Siegel, 1987; McCusker, Zapka, Stoddard, & Mayer, 1989; Slovic, Fischhoff, & Lichtenstein, 1978; Tyler, 1980). For example, people who believed they were invulnerable to suffering injuries from a car accident were the least likely to wear seatbelts (Slovic et al., 1978). Also, people who believed they were invulnerable to crime were the least likely to protect their home (Tyler, 1980). Thus, perceptions of absolute risk appear to influence the adoption of precautionary behavior (but see Gerrrard, Gibbons, & Bushman, 1996).

Moreover, three major health models include perceived vulnerability as a factor influencing the adoption of precautionary behavior (Becker, 1974; Maddux, Sherer & Rogers, 1983; Rogers, 1975; Weinstein, 1988). First, the Health Belief Model (HBM) includes perceived vulnerability as one of its four "basic ingredients" to motivate preventative behavior (Becker, 1974). Perceived vulnerability to negative events is regarded as a necessary but not sufficient precursor of precautionary behavior. Second, Protection Motivation Theory (PMT) states that information about a health hazard, perceptions of severity and efficacy influence perceived vulnerability (Maddux & Rogers, 1983; Rogers, 1975). According to PMT, the collective influence of these variables on perceived vulnerability to negative events motivates behavior. Third, the

Precaution Adoption Process describes a five step process in which acknowledgment of vulnerability acts as a necessary step to the decision to take precautions (Weinstein, 1988). Thus, possessing an optimistic bias, or illusion of invulnerability, may be hazardous to personal health if perceptions of vulnerability are essential to the adoption of precautionary behavior.

Numerous researchers offer empirical support for the negative relationship between the optimistic bias and the adoption of precautionary behavior (Burger & Burns, 1988; Davidson & Prkachin, 1997; Dolinski, Gromski, & Zawiska, 1988; Gerrard, Gibbons, & Warner, 1991; Gladis, Michela, Walter & Vaughan, 1996; Miller et al., 1990; Sheer & Cline, 1994; Sparks, Shepherd, Wieringer & Zimmermann, 1995; van der Velde et al., 1992; van der Velde & van der Pligt, 1991; Weinstein, 1982, 1984, 1987; Weinstein, Sandman, & Roberts, 1990). For example, women who were optimistically biased about their likelihood of becoming pregnant were less likely to use contraception (Burger & Burns, 1988; Gerrard, Gibbons & Warner, 1991). People with the darkest tans were more likely than people who were less tan to report an optimistic bias toward skin cancer (Miller et al., 1990). People who were optimistically biased about contracting influenza were less likely than those without an optimistic bias to get inoculated (Larwood, 1978). From this evidence alone, the optimistic bias seems to interfere with the adoption of precautionary behavior.

Although much research has demonstrated the harm associated with possessing optimistic beliefs, Taylor and Brown (1988) argue that being

optimistically biased may hold some benefits. In a recent review article, Armor and Taylor (1998) describe the benefits associated with the optimistic bias as better performance on tasks and greater ability to cope with threatening events. Indeed, some research has indicated that the optimistic bias may be beneficial to the adoption of precautionary behavior (Cohn, McFarlane, Yanez, & Imai, 1995; Davidson & Prkachin, 1997; Gerrard & Warner, 1991; Hoorens & Buunk, 1993; Moore & Rosenthal, 1991; van der Velde et al., 1992; van der Velde et al., 1994; Whitley & Hern, 1991). In one study, optimistic beliefs about contracting HIV lead to greater intentions to reduce risk (van der Velde et al., 1992). In another study, heavy smokers were less optimistically biased than occasional smokers about developing lung cancer (Moore & Rosenthal, 1991). Similarly, sexually active teenagers were less optimistically biased about contracting sexually transmitted diseases than non-sexually active teenagers (Cohn et al., 1995).

Finally, the optimistic bias may have little or no effect on precautionary behavior (Clarke, Williams, & Arthey, 1997; Segerstrom et al., 1993; Sparks et al., 1994; Vaughan, 1993; Weinstein, 1984, 1987). The decision to engage in precautionary behavior is complex and may be influenced by a number of variables other than the optimistic bias. For instance, Taylor, et al. (1992) note that optimistic gay men were just as likely as less optimistic gay men to engage in risky behavior. Similarly, perceived risk of developing lung cancer was unrelated to the desire to stop smoking (Segerstrom et al.,1993).

Methodological Concerns

Most research examining the relationship between the optimistic bias and precautionary behavior is correlational. Two problems arise when drawing inferences from correlational studies. First, it is impossible to determine the causal direction of a correlational relationship. It is not clear whether the optimistic bias influences the decision to take precautions, or taking precautions influences the optimistic bias. Some people may be optimistically biased because they have already taken or plan to take precautions. Others might not engage in precautionary behavior because they are optimistic about their likelihood of the negative event.

Recently, Weinstein and Nicolich (1993) noted that much of the research regarding the causal relationship between risk perceptions (in this case, the optimistic bias) and precautionary behavior is misinterpreted. For instance, many researchers conclude that a negative relationship between the optimistic bias and precautionary behavior indicates that the optimistic bias precedes a lack of precautionary behavior (see Gerrrard, Gibbons, & Bushman, 1996). Traditionally, however, researchers have measured these two constructs concurrently. Weinstein and Nicolich assert that by measuring optimism and precautionary behavior in this manner, the optimistic bias may be merely a reflection of precautionary behavior. Thus, a negative correlation between optimistic bias and precautionary behavior suggests that people are

misperceiving their risk at that point in time. However, no conclusions can be made about whether their behavior is a consequence of this optimism.

A second problem with drawing conclusions from correlational research is that other psychological processes may account for the relationship between the correlated variables. At present, a number of variables could be related to both the optimistic bias and precautionary behavior and may be responsible for their relationship. For example, past experience, perceived control, behavioral intentions, and anxiety, have been shown to influence both optimistic bias and precautionary behavior. When the impact of these variables on the existing relationship are taken into account, the relationship between the optimistic bias and precautionary behavior may no longer exist.

## THE PRESENT RESEARCH

Many researchers assume that the optimistic bias has a deleterious effect on precautionary health behavior (e.g., Weinstein, 1982), prompting people to underestimate their vulnerability to risk. This misperception of vulnerability is thought to interfere with the adoption of precautionary behavior. Although people who are optimistically biased do appear to underestimate their vulnerability to risk relative to a target person (Weinstein 1980, 1982, 1984, &1988), two lines of research provide evidence suggesting that people may nevertheless assess their personal (non-comparative) risk accurately.

First, some research reveals that people are optimistically biased relative to other people engaging in similar risk behavior, but are pessimistic when assessing their risk relative to the general public. For instance, smokers perceive themselves at less risk of suffering from lung cancer than other smokers; however, they perceive themselves at greater risk than non-smokers (McCoy et al., 1992; McKenna et al., 1993; Segerstrom et al., 1993; Steptoe et al., 1995; Strecher et al., 1995). Thus, smokers are relatively pessimistic in their assessment of health risk when comparing their risk to non-smokers, but are optimistic when comparing their risk to other smokers. Results of studies of women's perceptions of unplanned pregnancy and college student's perceptions

of contracting sexually transmitted diseases yield similar findings (Gerrard & Luus, 1995; Thompson, Anderson, Freedman, & Swan, 1996; Whitley & Hern, 1991). If perceived invulnerability leads people to engage in risky behavior, as proposed by many health behavior models, then people who are engaging in risky behavior should perceive themselves as less vulnerable than the general population (Taylor & Armor, 1998). However, the research just reviewed finds that people engaging in risky behavior believe they are more vulnerable than the general public, indicating that they may not misperceive their risk.

A second line of research also indicates that people who are optimistically biased may be assessing their personal risk accurately. Many researchers assume that the source of the optimistic bias lies in people's inclination to underestimate their personal risk. Yet, more recent research demonstrates that the source of the optimistic bias may lie in the tendency to overestimate a target's risk rather than underestimate personal risk (Burger & Burns, 1988; Rothman, Klein, & Weinstein, 1996; Taylor & Shepperd, 1998; Whitley & Hern, 1991). For example, women tended to be fairly accurate when assessing their absolute risk of getting pregnant, yet they overestimated other womens' chances of becoming pregnant (Burger & Burns, 1988; Whitley & Hern, 1991). Thus, the optimistic bias may be inappropriately termed the "illusion of invulnerability" because people may accurately view themselves as vulnerable, but view others as simply more vulnerable reflecting a '"pessimistic bias" for others.

In addition, past research has operationalized risk perceptions in terms of both comparative and non-comparative risk. First, perceived risk can be assessed by asking people to self-report their personal risk for some event in the future. This is termed a non-comparative risk estimate. Second, researchers can assess perceived risk by asking people to report their personal risk for an event and then compare it to either their risk perceptions for an average other to create a self-other comparative risk estimate or compare it to people's actual risk for the event to create a self-actual comparative risk estimate. A positive comparison reflects optimism and a negative comparison reflects pessimism. Most researchers examining the optimistic bias use the self-other risk estimate because it is often very difficult to compute people's actual risk of experiencing an event in the future.

Nevertheless, past researchers have assumed that a perceived invulnerabiity to risk, whether it is based on comparative or non-comparative risk judgements, will lead to a lack of precautionary behavior. However, it is possible that these two operations of perceived risk vary in their purpose and may relate differently to the adoption of precautionary behavior. Specifically, comparative risk estimates may fulfill a self-serving purpose, such as reducing negative affect, that may be experienced in anticipation of a negative event. Thus, comparative risk estimates, rather than reflecting precautionary behavior patterns, may reflect a desire to avoid negative affect. However, according to past research indicating that people are generally perceiving their personal risk

accurately, non-comparative risk estimates may predict precautionary behavior well. Thus, based on how risk perceptions are operationalized, researchers could make very different predictions about its relationship to precautionary behavior.

Furthermore, much of the research examining comparative risk estimates and precautionary behavior suffers from methodological limitations. Perhaps most importantly, Weinstein and Nicolich (1993) note that the vast majority of studies incorrectly conclude that correlations between the optimistic bias and precautionary behavior imply causation. To date, almost all of the studies conducted on this relationship are cross-sectional. That is, these studies measure comparative risk and precautionary behavior concurrently, and do not permit causal inferences.

Recently, researchers have recognized the great need for prospective data on the relationship between comparative risk estimates and precautionary behavior (Weinstein & Klein, 1996; Weinstein & Nicolich, 1993). Although longitudinal designs are often difficult and time-consuming, they represent an important way to assess the impact of comparative risk estimates on subsequent behavior. Surprisingly, however, only two studies have examined the relationship between comparative risk and precautionary behavior using longitudinal methods.

In the first study, van der Velde et al. (1992) found that comparative risk was negatively related to subsequent risk behavior. Specifically, participants

who were optimistically biased about contracting sexually transmitted diseases at the beginning of the study reported engaging in less risky sexual behavior four months later. However, this study consisted of primarily high risk participants (i.e. prostitutes) who may differ from the general population. Thus, the results of this study may not generalize to other populations. Specifically, these high risk participants have presumably already adopted their sexual habits. Weinstein and Nicolich (1993) speculate that once behavioral habits form, perceived risk may no longer influence precautionary behavior.

In a second study, Davidson and Prkachin (1997) compared participant's personal and target risk estimates for 11 health related events (including tooth decay, suicide, car accident, mugging and heart attack) and generated a global measure of comparative risk estimates. They then correlated this index with participants' change in subsequent exercise behavior. The results revealed that participants' global risk index was marginally negatively correlated with subsequent exercise measured 6 weeks later. Thus, participants who perceived themselves to be at the lowest comparative risk showed the greatest drop in precautionary behavior over time. Although Davidson and Prkachin (1997) investigate the effects of comparative risk on future behavior, by using a global measure of risk perception to assess comparative risk they do not measure the influence of perceived risk associated with a *specific* negative event on the adoption of future behavior intended to avoid that event. Finally, participants in the Davidson & Prakchin study were already engaging in precautionary behavior

at the beginning of the study (i.e. exercising), thus their research measured participants' change in precautionary behavior over time and not how comparative risk influenced the adoption of *new* precautionary behavior.

Overview and Predictions

The present research explored the relationship between perceived risk estimates and precautionary behavior. Specifically, I examined whether comparative and non-comparative risk estimates regarding experiencing an unplanned pregnancy are positively or negatively associated with contraceptive use. I also examined the possibility that a larger, overarching variable such as perceived control, behavioral intentions or past behavior is driving the relationship between non-comparative risk estimates and precautionary behavior. Finally, I attempted to conceptually replicate research (Davidson & Prkachin, 1997) indicating that the relationship between comparative risk estimates and future precautionary behavior depends on level of dispositional optimism.

I conducted a two-session longitudinal investigation of the association between college women's perceived risk about their likelihood of experiencing an unintended pregnancy and subsequent contraceptive behavior. Weinstein and Nicolich (1993) note that as time passes and habitual behaviors form, people become less likely to engage in precautionary behavior as a result of their perceived risk. Presumably, many of the women in this study do not have fully developed sexual beliefs and habits.

At the beginning and end of a three-month period, participants reported their perceived likelihood of an unplanned pregnancy, the average student's likelihood of an unplanned pregnancy, past risk behavior, future behavioral intentions, sexual knowledge, previous experience with pregnancy, anxiety, depression, and perceptions of control.

**Hypothesis 1:** In the present study, perceived risk was assessed both in terms of comparative and non-comparative risk. Furthermore, I attempted to assess comparative risk relative to both participants' perceptions of a target's risk (self-other risk) and participants' actual risk (self-actual risk). Consistent with past research, I predicted that participants would display an optimistic bias in both of their comparative risk estimates. Specifically, I expected that participants would estimate their likelihood of experiencing an unplanned pregnancy as less than that of a target and less than their actual risk. However, I predicted that risk estimates relative to actual risk (self-actual risk) would be more realistic than risk estimates relative to an average other (self-other risk), as suggested by past research (Burger & Burns, 1988; Whitley & Hern, 1991).

**Hypothesis 2:** My basic premise is that people, although optimistically biased relative to their perceptions of a target's risk, are generally accurate in their personal (non-comparative) risk estimates. On this basis, I expected that comparative risk estimates would be unrelated to precautionary behavior, but non-comparative risk estimates would be related to precautionary behavior. Specifically, I expected that comparative risk estimates, which generally portray

oneself to be better off than another, to reflect a self-serving purpose and not precautionary behavior patterns. Assuming that people will be self-serving to the extent that it is beneficial to them, comparative risk estimates should be used to make people feel good and reduce anxiety.

Alternatively, non-comparative risk estimates should be indicative of precautionary behavior. If people's personal risk perceptions are accurate, then their non-comparative risk estimates should correlate negatively with precautionary behavior. Thus, greater risk should be associated with a lack of precautionary behavior. Conversely, less risk should be associated with greater precautionary behavior.

**Hypothesis 3:** One purpose of this research was to examine the extent to which the relationship between non-comparative risk estimates and precautionary behavior is attributable to other psychological processes such as perceived control, behavioral intentions, and past behavior. I expected that each of these variables might be related to both perceived risk and precautionary behavior and thus could account for their relationship.[1]

Hypothesis 3a: Perceived Control. Perceptions of control are known to impact both behavior and risk perceptions. According to the theory of planned behavior, perceptions of behavioral control contribute directly and indirectly to

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[1] Of note, variables such as anxiety, depression, past experience and knowledge were considered as other variables that could account for the relationship in question but were found to be either uncorrelated with perceived risk or precautionary behavior and thus were not investigated further.

behavior (Ajzen, 1991; but see also Albarracin, Johnson, Muellerleile, & Fishbein, in press). Similarly, research on non-comparative risk reveals that people who perceive the most control over their behavior perceive themselves to be at the least risk. In the present study, I expected perceived control to correlate negatively with perceived risk at Time 1 and positively with precautionary behavior at Time 2. Moreover, perceived control may account for the relationship between non-comparative risk perceptions and precautionary behavior.

Hypothesis 3b: Behavioral Intentions. Also, on the basis of the theory of planned behavior and theory of reasoned action (Ajzen, 1991; Fishbein & Azjen, 1975), I investigated whether future behavioral intentions might drive the relationship between non-comparative risk and precautionary behavior. According to the theory of planned behavior, behavioral intentions contribute directly to future behavior. It is plausible that risk perceptions measured at Time 1 may be based on future intentions to engage in precautionary behavior and that these intentions directly impact behavior reported at Time 2. Thus, I expected behavioral intentions measured at Time 1 to correlate negatively with risk perceptions and positively with future behavior. Similar to perceived control, behavioral intentions may account for the relationship between non-comparative risk perceptions and precautionary behavior.

Hypothesis 3c: Past Behavior. The relationship between non-comparative risk-perceptions and future precautionary behavior may be driven

by differences in past precautionary behavior. In the present study, I expected that past precautionary behavior would correlate negatively with risk perceptions at Time 1 and positively with precautionary behavior at Time 2. I also tested whether differences in past behavior might be driving the relationship between non-comparative risk perceptions and precautionary behavior.

**Hypothesis 4:** Past research conducted by Davidson and Prkachin (1997) showed that the relationship between comparative risk estimates and precautionary behavior depends on level of dispositional optimism. Recall that Davidson and Prkachin (1997) constructed a self-other comparative risk index based on a wide range of health-related events and used this global comparative risk index to predict participants' change in exercise behavior over a six week period. Specifically, they found that people who scored relatively high on dispositional optimism and who perceived themselves at less risk than a target person at Time 1 showed the greatest decline in exercise by Time 2. Conversely, people who scored relatively high on dispositional optimism but who perceived themselves at greater risk than a target person at Time 1 showed the least decline in exercise by Time 2. These researchers reasoned that people, who were optimistically biased relative to a target person, expected positive future outcomes and thus would be less likely to engage in behavior to prevent negative events. Furthermore, they reasoned that people scoring relatively high on dispositional optimism have developed good coping strategies and would be more likely than people scoring low on dispositional optimism to exercise. On

the basis of these past findings, one purpose of the present study was to replicate Davidson and Prkachin's (1997) research and examine whether the interaction between dispositional optimism and comparative risk estimates at Time 1 was associated with contraceptive behavior at Time 2.

## METHOD

### Participants

Participants in the present study were selected from a subset of 354 female students who indicated in a prescreening session that they had engaged in consensual sexual intercourse with a member of the opposite sex in the past year. 159 participants completed the questionnaire at Time 1 and of those, 148 participants returned to complete the questionnaire again at Time 2. Out of the participants who completed both waves of the study, 111 reported that they had engaged in sexual intercourse both in the six months prior to Time 1 and in the interim between Time 1 and Time 2. Only data from these participants were used in subsequent analyses.

### Procedure

The present study took place over two sessions, three months apart. In the first session, participants completed a questionnaire packet assessing their sexual experience, relative risk of pregnancy, past and future contraceptive behavior, perceptions of control, anxiety, self-esteem, past experience, and sexual knowledge. Three months later, participants returned and completed a similar questionnaire.

## Measured Variables

### Preliminary Information

At the first session, participants reported their age, whether they had engaged in consensual intercourse, number of sexual partners, and the age of their first sexual encounter. In addition, participants reported how favorable an unplanned pregnancy would be if it happened to them on a 7-point scale ranging from (-3) bad to (+3) good. Table 1 presents the mean, standard deviation, and range of each of these items. In addition, participants reported their relationship status using DeLamater and MacCorquodale's (1979) 6-point scale ranging from (1) not dating to (6) living together. Table 2 presents the frequencies of participants' relationship status.

### Risk Estimates

Participants rated the likelihood that they and the average college student at their university would become pregnant in the next three months on a scale of (1) not at all to (9) certain. In addition, participants rated their personal probability and a target's probability of experiencing an unplanned pregnancy on a second scale ranging from 0 to 100%.

### Behavior

In the first and second sessions, participants reported both their past and intended future behavior. In both sessions, participants reported the number of times they had engaged in consensual sexual intercourse and separately

Table 1.

Descriptive Statistics

| | Mean | Std | Range |
|---|---|---|---|
| Age | 18.53 | 1.00 | 17 - 21 |
| Age at first intercourse | 16.34 | 1.32 | 13 - 20 |
| Number of Lifetime Partners | 3.21 | 2.70 | 1 - 14 |
| Favorability of Unplanned Pregnancy[a] | -2.73 | 0.75 | -3 -1 |

Note: [a] Measured on a 7 point scale ranging from (-3) bad to (+3) good.

Table 2.

Relationship Status

| Status | Frequency | % |
|---|---|---|
| Not dating | 12 | 10.8 |
| Casually dating one or more people | 24 | 21.6 |
| Dating mostly one person | 19 | 17.1 |
| Dating only one person seriously | 52 | 46.8 |
| Living together | 4 | 3.6 |
| Married | 0 | 0.0 |

Note: N=111.

reported the percentage of time they used contraception and birth control effectively. Additionally, in both sessions, participants reported the number of times they had used each form of birth control (see Appendix A). In the first session, participants referred to their sexual behavior in the past six months and in the second session they referred to their sexual behavior in the three months between the first and second sessions. Although the time periods differed in length, participants reported the percentage of time they had engaged in each behavior and thus their responses should not be affected by differences in duration. Then, in both sessions, participants estimated the percentage of time they intended to use effective birth control in the next three months.

Perceived Control

Two items assessed the extent to which participants felt that a) they had control over avoiding an unplanned pregnancy, and b) that avoiding a pregnancy was partly a matter of luck. Participants responded to these items on a 9-point scale ranging from (1) not at all to (9) very much. These items were highly correlated ($r = .44$, $p < .0001$) and were averaged to form a composite index of perceived control, range 3.5 to 9.0, $M = 7.75$, $SD = 1.39$, Cronbach's alpha =.62.

Knowledge

Sexual knowledge was assessed via the 24-item multiple choice/true-false version of the Miller-Fisk Sexual Knowledge Questionnaire distributed at Time 1 (Gough, 1974) (See Appendix B). Appropriate for studies on

contraceptive and sexual behavior, this measure assesses knowledge with regard to reproductive physiology, contraceptive methods and topics related to fertility and infertility. A total score was calculated by summing the number of correct responses. Past research has demonstrated this scale to possess adequate reliability (odd-even reliability = .67) (Gough, 1974). Of note, females (M = 16.55, SD = 3.47) tend to score slightly higher than males (M = 15.94, SD = 3.69) on this scale. In the present research, females scored lower than the expected average, range 9 to 22, M = 15.29 ,SD = 2.8. Moreover, the scale lacked adequate reliability (Cronbach's alpha = .42), perhaps because it uses out-dated terminology and is undoubtedly confusing to some participants. Therefore, any findings based on this scale are inconclusive, as it is unclear whether this scale is truly assessing participants' sexual knowledge.

Anxiety

Participants reported their anxiety on the State Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970, see Appendix C). Participants responded by indicating how they felt in response to a variety of items on a 4-point scale, (1=not at all, 2=somewhat so, 3=moderately so, and 4=very much so). A scale score was constructed by summing all 20 items after reverse coding the appropriate items. Higher numbers indicate greater anxiety. In past research, this scale has demonstrated adequate reliability (Spielberger, 1971) and validity (Andreatini & Leite, 1994; Gaudry, Vagg & Spielberger, 1975; Spielberger & Vagg, 1984). In present research, these items were highly

intercorrelated (Cronbach's alpha = .91) and were consequently summed to form an anxiety scale score (range 33 to 80, M = 63.6, SD = 9.5).

Past Experience

Participants reported separately whether they or a close friend had ever experienced an unwanted pregnancy and, if appropriate, when such an event occurred (see Appendix D).

Life Orientation Task

Participants completed the 8-item Life Orientation Task (LOT) at both Time 1 and Time 2 (see Appendix E, Scheier & Carver, 1985). The scale demonstrates adequate predictive validity (Lai, 1994), convergent validity (Williams, 1992) and discriminant validity (Smith, Pope, Rhodewalt, & Poulton, 1989). Although factor analyses of the items on the LOT have revealed a two factor structure, one indicating optimism and the other indicating pessimism, researchers commonly treat the scale as unidimensional (Davidson & Prkachin, 1997). To this end, in the present study the pessimism items were reverse scored and averaged with the other items to create an index of dispositional optimism, range = 12 to 39, M = 29.0, SD = 4.9, Cronbach's alpha = .85 at Time 1, range = 16 to 39, M = 29.5, SD = 4.5, Cronbach's alpha = .84 at Time 2, test-retest reliability = .66, $p < .0001$.

## RESULTS

### Hypothesis 1

Were participants optimistically biased about the possibility of an unplanned pregnancy? Recall that the present study attempted to assess risk estimates relative to both risk perceptions of an 'average other ' and actual risk based on specific self-reported behavior. Also, participants estimated personal risk and a target's risk on separate likelihood measures (ranging from 1-9) and again on separate probability measures (ranging from 0-100).

Of note, actual risk of experiencing an unplanned pregnancy can be calculated for each participant by summing the product of each birth control method's effectiveness and the number of times each method was used. This sum is then divided by the total number of times each participant reported having consensual sexual intercourse (see Appendix A). In the present study, I decided that actual risk could not be calculated accurately for most participants due to difficulties encountered in the administration of the behavioral measure.[2]

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[2] Three problems emerged when I attempted to analyze data from the behavioral measure. First, a number of participants skipped the detailed items of the behavioral measure or provided check marks indicating which methods they had used but not how many times they used each method. Second, participants did not provide information about every time they had engaged in consensual sexual intercourse. Third, many participants used multiple methods during intercourse and use of their data would be misleading given how I intended to calculate actual risk.

Although I could not calculate actual risk for each participant, for illustration purposes, I decided to compare participants' personal risk estimates to the national average for unplanned teenage pregnancies as an additional measure of comparative risk (self-standard risk). Recent statistics show that, in the United States, 13.24% of sexually active female students between the ages of 18 and 19 experience an unintended pregnancy (CDC, 1998). Therefore, to compute a self-standard comparative risk estimate, participants' personal risk estimates on the probability measure were subtracted from the 13.24% standard and their personal risk estimates on the likelihood measure were subtracted from 2.06 (exactly 13.24% on the 1 to 9 scale). Admittedly, it may be problematic to create a self-standard difference score using the likelihood measure. First, it is not clear that participants interpret a '2' on this 9-point scale to be roughly equivalent to 13%. Second, 2.06 is not a response option on this scale. Despite these limitations, the likelihood measure was used tentatively as an additional assessment of self-standard risk perceptions. Also, as planned, I computed a self-other comparative risk estimate, in which participant's personal risk estimates were subtracted from their estimates of the target's risk. For all measures, positive difference scores reflect optimism, negative difference scores reflect pessimism and difference scores near zero reflect realism.

A series of dependent t-tests assessed whether comparative risk estimates were different from zero. Table 3 presents the mean, standard deviation, and dependent t-test for each difference score separately at Time 1

Table 3.

Comparative Risk Estimates

| | Probability Estimates | | | | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std | t | p | r |
| Self-Other | | | | | | |
| Time 1 | 109 | 25.02 | 17.46 | 14.96 | .0001 | .82 |
| Time 2 | 111 | 25.91 | 19.40 | 14.07 | .0001 | .80 |
| Self-Standard | | | | | | |
| Time 1 | 110 | 8.19 | 8.79 | 9.77 | .0001 | .68 |
| Time 2 | 111 | -1.47 | 16.25 | -0.92 | .3437 | .09 |

| | Likelihood Estimates | | | | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std | t | p | r |
| Self-Other | | | | | | |
| Time 1 | 110 | 2.39 | 1.40 | 17.97 | .0001 | .86 |
| Time 2 | 111 | 2.62 | 1.53 | 18.10 | .0001 | .86 |
| Self-Standard | | | | | | |
| Time 1 | 110 | 0.65 | .76 | 9.01 | .0001 | .65 |
| Time 2 | 111 | -0.03 | 1.28 | -0.25 | .8043 | .02 |

and Time 2. As expected, when personal risk estimates were compared to target risk estimates, people displayed an optimistic bias. However, when personal risk estimates were compared to the 13.24% standard, people were optimistically biased at Time 1 but realistic at Time 2. Table 4 presents the frequency of participants who were optimists, realists and pessimists for each comparative risk measure. As is visually apparent in Table 4, self-other risk estimates yielded a greater number of optimists than self-standard risk estimates. In addition, self-standard estimates appear to reveal more optimism at Time 1 than at Time 2.

It is unclear why I found greater optimism at Time 1 than Time 2 using the self-standard approach to assess comparative risk. The shift from optimism to realism over time was not due to changes in precautionary behavior over the duration of the study. Participants reported engaging in precautionary behavior on average 82% and 83% of the time at the first and second sessions, respectively. In addition, sexual frequency did not increase significantly from Time 1 ($\underline{M}$ = 6.0 events per month) to Time 2 ($\underline{M}$ = 5.7 events per month). Finally, no participants reported having personally experienced an unplanned pregnancy over the duration of the study and whether or not participants had a close friend experience an unplanned pregnancy over the duration of the study was uncorrelated with their non-comparative risk at Time 2 ( $\underline{r}$ = -.01, $\underline{p}$ = .85).

Table 4.

Percentage of Optimists, Pessimists and Realists

| | Probability Estimates | | |
|---|---|---|---|
| | Pessimists | Realists | Optimists |
| Self-Other | | | |
| Time 1 | 0% | 2% | 98% |
| Time 2 | 3% | 4% | 93% |
| Self-Standard | | | |
| Time 1 | 11% | 0% | 89% |
| Time 2 | 37% | 0% | 63% |

| | Likelihood Estimates | | |
|---|---|---|---|
| | Pessimists | Realists | Optimists |
| Self-Other | | | |
| Time 1 | 0% | 5% | 95% |
| Time 2 | 0% | 4% | 96% |
| Self-Standard | | | |
| Time 1 | 8% | 24% | 68% |
| Time 2 | 31% | 27% | 42% |

In sum, consistent with Hypothesis 1, when personal risk estimates were made relative to participants' risk estimates for the average student, the results showed that participants were generally optimistically biased about their likelihood of experiencing an unintended pregnancy. However, when personal risk estimates were made relative to the population standard, the results showed that participants were optimistically biased about their likelihood of experiencing an unplanned pregnancy Time 1 and realistic about their likelihood at Time 2.

Hypothesis 2

Do comparative and non-comparative risk estimates predict precautionary behavior? Tables 5 and 6 present the correlations between risk estimates and precautionary behavior for both the probability and likelihood measures. In the present study, I predicted that comparative risk estimates would be unrelated to precautionary behavior whereas non-comparative risk estimates would be significantly related to precautionary behavior. As expected, Tables 5 and 6 suggest that comparative risk estimates were not associated with precautionary behavior. In only 2 of 24 cases were self-other risk estimates and precautionary behavior correlated. Specifically, only the correlations between contraceptive use reported at Time 1 and self-other risk estimates at Time 2 were significant for both the probability measure and the likelihood measure. In addition, I hypothesized that self-other estimates, while unrelated to precautionary behavior, should be related to anxiety. Consistent with this hypothesis, anxiety correlated significantly with self-other estimates, $r = -.18$, $p = .05$ such that

Table 5.

Correlations for the Risk Estimate-Precautionary Behavior Relationship Using the Probability Measure

| | Risk Estimates | | | |
|---|---|---|---|---|
| | Comparative | | Non-comparative | |
| Behavior at Time 1 | Time 1 | Time 2 | Time 1 | Time 2 |
| Contraception | -.057 | -.219* | -.285** | -.284** |
| Birth Control Use | .012 | -.144 | -.383** | -.285** |
| Intent to Use Birth Control | .013 | -.060 | -.323** | -.171 |

| | Risk Estimates | | | |
|---|---|---|---|---|
| | Comparative | | Non-comparative | |
| Behavior at Time 2 | Time 1 | Time 2 | Time 1 | Time 2 |
| Contraception | -.062 | -.074 | -.287** | -.333** |
| Birth Control Use | -.065 | -.057 | -.349** | -.380** |
| Intent to Use Birth Control | -.038 | .041 | -.332** | -.245** |

Note: * : $p \leq .05$, ** : $p \leq .01$ .

Table 6.

Correlations for the Risk Estimate-Precautionary Behavior Relationship Using the Likelihood Measure

| | Risk Estimates | | | |
|---|---|---|---|---|
| | Comparative | | Non-comparative | |
| Behavior at Time 1 | Time 1 | Time 2 | Time 1 | Time 2 |
| Contraception | .057 | -.186* | -.344** | -.246** |
| Birth Control Use | .094 | -.155 | -.373** | -.269** |
| Intent to Use Birth Control | .023 | -.042 | -.241* | -.169 |

| | Risk Estimates | | | |
|---|---|---|---|---|
| | Comparative | | Non-comparative | |
| Behavior at Time 2 | Time 1 | Time 2 | Time 1 | Time 2 |
| Contraception | -.156 | .019 | -.288** | -.318** |
| Birth Control Use | -.019 | .002 | -.345** | -.404** |
| Intentions to Use Birth Control | -.039 | -.001 | -.363** | -.246** |

Note: *: $p \leq .05$, **: $p \leq .01$.

participants reporting more optimistic self-other risk estimates were less anxious. Of note, non-comparative risk estimates were unrelated to self-reported anxiety, $r = .00$, $p = .99$.

Tables 5 and 6 also reveal that non-comparative risk estimates were significantly related to precautionary behavior. Specifically, people who perceived themselves to be at less risk for an unplanned pregnancy engaged in greater precautionary behavior. People who perceived themselves to be at greater risk engaged in less precautionary behavior.

In sum, consistent with the predictions, the data reveal that non-comparative risk estimates were associated with precautionary behavior. Conversely, comparative risk estimates were not associated with precautionary behavior but rather with the reduction of anxiety.

Hypothesis 3

I hypothesized that some larger, overarching variable may be producing differences in both risk estimates and precautionary behavior. Tables 7, 8, and 9 show the correlations between a number of psychological variables measured in the present study and both risk estimates and precautionary behavior. Specifically, I hypothesized that three psychological variables (perceived control, behavioral intentions and past behavior) might account for the relationship between non-comparative risk estimates and precautionary behavior. To test this possibility, I analyzed the effect of non-comparative risk estimates on precautionary behavior in three separate analyses in which I statistically

Table 7

Correlations Between Probability Risk Estimates and Other Measured Variables

| | Probability Estimates | | | |
|---|---|---|---|---|
| | Non-comparative Risk | | Comparative Risk | |
| | Time 1 | Time 2 | Time 1 | Time 2 |
| Non-comparative Risk (T1) | -- | | | |
| Non-comparative Risk (T2) | -.32** | -- | | |
| Comparative Risk (T1) | -.10 | .18* | -- | |
| Comparative Risk (T2) | -.04 | -.32** | .16* | -- |
| Past Experience (T1) | -.13 | -.13 | .08 | -.06 |
| Past Experience (T2) | .05 | -.13 | .12 | -.14 |
| Perceived Control (T1) | -.27** | -.15 | -.04 | -.13 |
| Perceived Control (T2) | -.33** | -.33** | -.19** | .00 |
| Optimism (T1) | -.18* | -.11 | -.06 | .02 |
| Optimism (T2) | -.13 | -.11 | -.04 | .10 |
| Anxiety (T1) | .00 | -.07 | -.18* | .08 |
| Knowledge (T1) | -.04 | .11 | -.22** | -.17* |

Note: $N$ = 111. * = $p < .10$, ** = $p < .05$.

Table 8

Correlations Between Likelihood Risk Estimates and Other Measured Variables

| | Likelihood Estimates | | | |
|---|---|---|---|---|
| | Non-comparative Risk | | Comparative Risk | |
| | Time 1 | Time 2 | Time 1 | Time 2 |
| Non-comparative Risk (T1) | -- | | | |
| Non-comparative Risk (T2) | -.41** | -- | | |
| Comparative Risk (T1) | -.14 | .14* | -- | |
| Comparative Risk (T2) | -.11 | -.31** | .19* | -- |
| Past Experience (T1) | -.07 | -.15 | .03 | -.10 |
| Past Experience (T2) | -.01 | -.12 | .08 | -.16* |
| Perceived Control (T1) | -.27** | -.24** | -.00 | .03 |
| Perceived Control (T2) | -.38** | -.33** | -.14 | .05 |
| Optimism (T1) | -.18* | -.13 | -.08 | .07 |
| Optimism (T2) | -.20** | -.08 | .08 | .08 |
| Anxiety (T1) | -.10 | -.10 | -.11 | -.08 |
| Knowledge (T1) | .02 | .08 | -.23** | -.18* |

Note: N = 111. * = p < .10, ** = p < .05.

Table 9

Correlations between Self-Reported Behavior and Other Measured Variables

| | Self-Reported Behavior | | | |
|---|---|---|---|---|
| | Contraceptive Use | | Birth Control Use | |
| | Time 1 | Time 2 | Time 1 | Time 2 |
| Contraceptive Use (T1) | -- | | | |
| Contraceptive Use (T2) | .51** | -- | | |
| Birth Control Use (T1) | .84** | -.14* | -- | |
| Birth Control Use (T2) | .59** | .31** | .60** | -- |
| Past Experience (T1) | .22** | .15 | .16* | .22** |
| Past Experience (T2) | .19 | .10 | .17* | .14* |
| Perceived Control (T1) | .24** | .22** | .35** | .29** |
| Perceived Control (T2) | .16** | .24** | .25** | .29** |
| Optimism (T1) | .15 | .04 | .10 | -.01 |
| Optimism (T2) | .13 | .00 | .09 | -.07 |
| Anxiety (T1) | .13 | .07 | .08 | -.05 |
| Knowledge (T1) | .03 | .09 | .06 | .01 |

Note: N = 111. * = p < .10, ** = p < .05.

controlled for perceived control, behavioral intentions, and past behavior. If one or more of these variables accounts for the relationship between non-comparative risk and precautionary behavior, then statistically controlling for them should significantly reduce the relationship. If they do not account for the relationship, then statistically controlling for them should not significantly reduce the relationship. I describe the results below for each variable separately.

Hypothesis 3a: Perceived Control

It is possible that perceptions of control are responsible for the relationship between non-comparative risk (Time 1) and precautionary behavior (Time 2). A sketch of the model representing how perceived control could account for the relationship between perceived risk and precautionary behavior is presented in Figure 1.

I tested the model statistically using a series of regression analyses. The analyses involved the perceived control index described earlier and an ad hoc non-comparative risk index that was created by transforming the likelihood measure to the same scale as the probability measure and averaging the two for Time 1. In addition, analyses were conducted separately for contraceptive behavior and birth control use reported at Time 2. First, prior analyses indicated that perceived risk index correlated negatively with contraceptive behavior ($r$ (109) = -.30, $p$ =.001) and birth control use ($r$ (108) = -.37, $p$<.0001) (path a). Second, perceived control correlated negatively with the non-comparative risk index ($r$ (109) = -.29, $p$ =.002) (path b). Third, perceived control

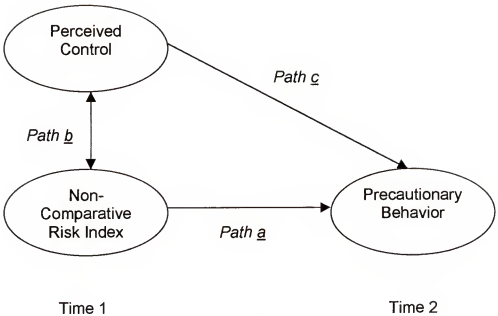


Figure 1. Possible relationship between perceived control, non-comparative risk and precautionary behavior.

correlated positively with both contraceptive behavior ($r$ (110) = .22, $p$ = .02) and birth control use ($r$ (109) = .29, $p$ =.002) (path $c$). Finally, I entered perceived control and the non-comparative risk index simultaneously into a regression model to control for differences between optimists and pessimists in perceived control. The non-comparative risk index remained a significant predictor of contraceptive behavior, standardized beta = .26, $t$ (109) = -2.75, $p$ = .007, $r$ = -.25, and birth control use, standardized beta = .31, $t$ (108) = -3.36, $p$ = .001, $r$ = -.31. Thus, perceived control is not responsible for the relationship between non-comparative risk differences and precautionary behavior.

Hypothesis 3b: Behavioral Intentions

It is possible that behavioral intentions are responsible for the relationship between non-comparative risk differences and future precautionary behavior. A sketch of the model representing how behavioral intentions could account for the relationship between non-comparative risk differences and precautionary behavior is presented in Figure 2.

I tested the model statistically using a series of regression analyses. As in the previous set of analyses, the non-comparative risk index was used to represent risk estimates at Time 1 and analyses were conducted separately for contraceptive use and birth control use reported at Time 2. As noted earlier, the non-comparative risk index correlated negatively with contraceptive behavior ($r$ (109) =-.30, $p$ =.001) and birth control use ($r$ (108) = -.37, $p$<.0001) (path $a$). Analyses also indicated that behavioral intentions correlated negatively with the

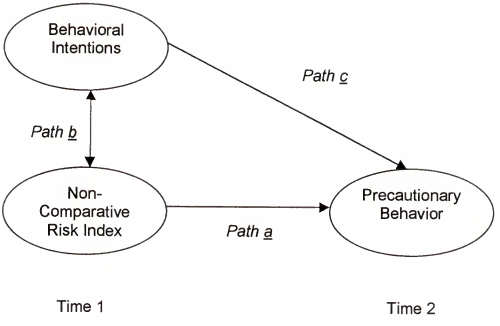


Figure 2. Possible relationship between behavioral intentions, non-comparative risk and precautionary behavior.

non-comparative risk index ($r$ (109) = -.30, $p$ =.002) (path b). Additional analyses revealed that behavioral intentions correlated positively with both contraceptive behavior ($r$ (110) = .35, $p$ = .0002) and birth control use ($r$ (109) = .44, $p$ <.0001) (path c). Finally, I entered the behavioral intentions and the non-comparative risk index simultaneously into a regression model to control for differences in behavioral intentions. Non-comparative risk differences remained a significant predictor of contraceptive behavior, standardized beta = .22, $t$ (109) = -2.38, $p$ = .019, $r$ = -.22, and birth control use, standardized beta = .26, $t$ (108) = -2.93, $p$ = .004, $r$ = -.27. Thus, behavioral intentions are not responsible for the relationship between non-comparative risk differences and precautionary behavior.

Hypothesis 3c: Past Behavior

It is also possible that past precautionary behavior is responsible for both variations in non-comparative risk differences and future precautionary behavior. A sketch of the model representing how past precautionary behavior could account for the relationship between perceived risk and precautionary behavior is presented in Figure 3.

I tested the model statistically using a series of regression analyses. Once again, the non-comparative risk index was used to represent risk estimates at Time 1. I conducted separate analyses for contraceptive behavior and birth control use (i.e., past contraceptive behavior (Time 1) was used to predict future

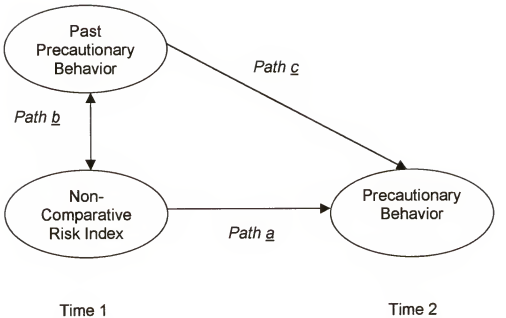


Figure 3. Possible relationship between past precautionary behavior, non-comparative risk and precautionary behavior.

contraceptive behavior (Time 2) and past birth control use (Time 1) was used to predict future birth control use (Time 2)). Again, as noted earlier, the non-comparative risk index correlated negatively with future contraceptive behavior ($r$ (109) = -.30, $p$ =.001) and future birth control use ($r$ (108) = -.37, $p$<.0001) (path a). Likewise, the non-comparative risk index correlated negatively with past contraceptive behavior ($r$ (109) = -.34, $p$ =.0001) and past birth control use ($r$ (109) = -.37, $p$ =.0001) (path b). Additional analyses revealed that past contraceptive behavior correlated positively with future contraceptive use, ($r$ (110)= .51, $p$ <.0001) and past birth control use correlated with future birth control use, ($r$ (109) = .60, $p$ <.0001) (path c). Finally, I used regression to control statistically for past precautionary behavior. Analyses revealed that the non-comparative risk index only marginally predicted contraceptive behavior, standardized beta = .15, $t$ (109) = -1.73, $p$ = .086, $r$ = -.16, and birth control use, standardized beta = .14, $t$ (109) = -1.70, $p$ = .093, $r$ = -.16. These results indicate that past precautionary behavior at least partially accounts for the relationship between non-comparative risk estimates and future precautionary behavior.

In sum, perceived control, behavioral intentions, and past precautionary behavior were each related to both non-comparative risk and future precautionary behavior. The results revealed that perceived control and behavioral intentions were not responsible for the relationship between self-standard differences and future precautionary behavior but that differences in

past precautionary behavior seem to at least partially account for the relationship.

Hypothesis 4

Does the relationship between comparative risk estimates and future behavior depend on level of dispositional optimism? In the present study, I conducted a conceptual replication of research conducted by Davidson and Prkachin (1997). I expected that dispositional optimism and self-other comparative risk estimates would interact to predict change in contraceptive behavior over time. Specifically, I expected that people who scored relatively high on dispositional optimism and who perceived themselves at less risk than a target person at Time 1 would show the *greatest* decline in precautionary behavior by Time 2. Conversely, I expected that people who scored relatively high on dispositional optimism but who perceived themselves at greater risk than a target person at Time 1 would show the *least* decline in precautionary behavior by Time 2.

Consistent with Davidson and Prkachin (1997), I conducted a regression analysis to determine whether the interaction between dispositional optimism and comparative risk predicted the change in contraceptive behavior over time. As with the test of Hypothesis 3, a comparative risk index was constructed by standardizing and averaging the likelihood and probability estimates made at Time 1. A change score was constructed by subtracting precautionary behavior reported at Time 1 from behavior reported at Time 2. Thus, a positive change

score indicated an increase in precautionary behavior over time and a negative change score indicated a decrease in precautionary behavior. Furthermore, I covaried out Time 1 contraceptive behavior to leave only the variance associated with change across time (Manuck, Kasprowicz, & Muldoon, 1990). Thus, after centering, I entered past precautionary behavior, dispositional optimism, the comparative risk index and the cross product of optimism and comparative risk simultaneously into a regression model to predict change in contraceptive behavior. Analyses were conducted separately for contraceptive behavior and birth control use. Tables 10 and 11 reveal that only past precautionary behavior was significantly related to change in behavior over time. Moreover, analysis revealed that the interaction term for comparative risk and dispositional optimism was not significant for either the analysis for change in contraceptive behavior over time, $t$ (109) = -1.35, $p$ = .18, $r$ = .13, or the analysis for change in birth control use over time, $t$ (108) = 0.92, $p$ = .36, $r$ = .09. Thus, contrary to Davidson and Prkachin (1997), the relationship between self-other comparative risk estimates and future contraceptive behavior does not vary significantly as a function of dispositional optimism when statistically controlling for past contraceptive behavior.

Table 10.

Summary of Regression Analysis for Variables Predicting Change in Contraceptive Behavior

| Variable | B | SE B | β |
|---|---|---|---|
| Contraceptive Behavior at Time 1 | -.45 | .09 | -.45* |
| Dispositional Optimism | -.43 | .66 | -.06 |
| Self-Other Comparative Risk Index | -.14 | .17 | -.07 |
| Interaction | -.06 | .04 | -.12 |

Note: * $p < .05$, $R^2 = .25$, $p < .001$, Adjusted $R^2 = .22$

Table 11.

Summary of Regression Analysis for Variables Predicting Change in Birth Control Use

| Variable | B | SE B | β |
|---|---|---|---|
| Birth Control Use at Time 1 | -.41 | .07 | -.47* |
| Dispositional Optimism | -.59 | .59 | -.09 |
| Self-Other Comparative Risk Index | -.18 | .15 | -.10 |
| Interaction | -.04 | .04 | -.08 |

Note: * $p < .05$, $R^2=.25$, $p < .001$, Adjusted $R^2 = .22$

## DISCUSSION

The results of this longitudinal study revealed several interesting findings. First, consistent with prior research, the present study revealed that participants' comparative risk estimates were generally optimistic. Second, non-comparative risk estimates were associated with subsequent precautionary behavior, but comparative risk estimates were not. Third, neither perceived control nor behavioral intentions accounted for the relationship between non-comparative risk estimates and future precautionary behavior and past behavior at least partially accounted for this relationship. Fourth, contrary to past research, when controlling for differences in past behavior, the relationship between comparative risk estimates and future precautionary behavior did not depend on dispositional optimism.

### Comparative vs. Non-Comparative Risk

Many researchers have assumed that biases such as the optimistic bias are mentally or physically harmful. The present research suggests, however, that the optimistic bias is not harmful and may even be associated with positive mental well-being. For example, in the present study, more optimistic self-other comparative risk estimates were associated with less anxiety. Thus, optimistic comparative risk estimates may promote mental well-being. In addition, people

who perceived themselves to be at low risk of experiencing an unintended pregnancy engaged in the most precautionary behavior. This finding provides evidence that more favorable non-comparative risk estimates may promote physical well-being.

The present data also suggest that the two operationalizations of perceived risk, comparative and non-comparative risk, may vary in their function. First, self-other comparative risk estimates seem to reflect a desire to feel good rather than reflect precautionary behavior patterns. In fact, in the present study, comparative risk was poorly associated with precautionary behavior. At first blush, this finding seems inconsistent with past research indicating that comparative risk estimates are negatively related to precautionary behavior (e.g., Burger & Burns, 1988; Weinstein, 1982). However, I reasoned that comparative risk estimates reveal nothing about people's actual risk. Although people are generally optimistically biased relative to a target person, it is unclear whether they are optimistic, pessimistic or realistic about their personal (non-comparative) risk. The failure to examine perceptions of personal risk independent of risk ratings for a target may explain why past research using comparative risk estimates to predict behavior has found that comparative risk relates positively, negatively and neutrally to subsequent behavior. Furthermore, it is likely that people are optimistic only to the extent that it is beneficial for them. Given that putting one's health at risk is not beneficial, I conclude that people maintain optimistic self-other risk estimates to make

themselves feel good or reduce anxiety but do not allow these perceptions to interfere with the adoption of precautionary behavior.

A second operationalization of perceived risk, non-comparative risk estimates, might function differently than comparative risk estimates and reflect precautionary behavior. The present research showed that more favorable non-comparative risk estimates at Time 1 were associated with greater precautionary behavior at Time 2. People who would engage in the most precautionary behavior correctly assumed that they were the least at risk and people who would engage in the least precautionary behavior correctly assumed that they were at the most risk. Thus, the present data suggest that people are accurately assessing their risk rather than being 'unrealistically' optimistic as demonstrated by the comparative risk measure. In other words, although the present study demonstrates that people are generally optimistically biased relative to a target person, they do not seem to be 'unrealistically' optimistic because they correctly perceive their risk to be a function of their precautionary behavior.

In sum, optimistic comparative risk estimates (i.e. judging personal risk as lower than the risk of the average person), while not interfering with the adoption of future precautionary behavior, appear to be beneficial to the extent that they act as a buffer against negative affect. In addition, more favorable non-comparative risk perceptions also do not appear to interfere with, but rather are associated with greater future precautionary behavior.

Impact of Other Variables on the Perceived Risk-Behavior Relationship

One purpose of the present research was to examine the extent to which the relationship between non-comparative risk estimates and precautionary behavior was attributable to other larger psychological processes such as perceived control, behavioral intentions, and past behavior. In the present study, these variables were related to both non-comparative risk and precautionary behavior and may have accounted for their relationship.

First, the results revealed that the relationship between non-comparative risk and future precautionary behavior was not attributable to differences in perceived control. Second, the results showed that differences in behavioral intentions at Time 1 do not explain the relationship between non-comparative risk and subsequent precautionary behavior. Third, the present research also revealed that, although non-comparative risk estimates predict future precautionary behavior, this relationship is at least partially due to differences in past precautionary behavior. It is important to note that past precautionary behavior did not entirely account for this relationship. This finding provides evidence supporting the basic premise that non-comparative risk estimates are based in reality. People who have taken precautions against unintended pregnancy in the past, estimate that their future risk of pregnancy is lower than people who did not take precautions in the past.

Comparative Risk Estimates and Dispositional Optimism

One purpose of the present research was to investigate whether the relationship between comparative risk estimates and future precautionary behavior depends on dispositional optimism. Seemingly contrary to Davidson and Prkachin's (1997) study, I found that when controlling for differences in past precautionary behavior, the interaction between self-other comparative risk estimates and dispositional optimism was unrelated to future precautionary behavior. I offer two explanations for this finding.

First, the present study and Davidson and Prkachin's study operationalize self-other risk differently. In the present study, a self-other difference score is measured with respect to a single, specific event - unintended pregnancy. As mentioned earlier, Davidson and Prkachin measured self-other risk globally with respect to a wide range of negative events (i.e. murder, suicide, car accident). It is conceivable that Davidson and Prkachin's measure taps a slightly different construct than my measure. If self-other differences are maintained to help people feel good or reduce anxiety, I am presumably tapping the desire to reduce anxiety about the possibility of experiencing an unintended pregnancy. Their measure may be tapping the desire to reduce anxiety on a larger scale. Furthermore, Davidson and Prkachin mention in a footnote that they conducted a second set of analyses in which they substituted a single measure of heart attack risk for their global risk measure. When measuring comparative risk with

respect specific event (heart attack), they found that it did not interact with dispositional optimism to predict subsequent exercise behavior. Thus, although the present findings seem to contradict those of Davidson and Prkachin, I actually find results similar to theirs when they use a specific measure in place of the global measure.

Second, how comparative risk estimates and dispositional optimism relate to precautionary behavior may depend on the consequences associated with the failure to take precautionary action. Davidson and Prkachin measured exercise behavior, whereas, in the present study, I measure contraceptive behavior. If, for example, a healthy 19-yr-old student misses a workout or neglects his/her exercise routine for a couple of weeks, the result is relatively inconsequential (i.e. there is not an immediate risk of a heart attack). However, if the same 19-yr-old student fails to use a contraceptive method during intercourse, the result, an unintended pregnancy, could be highly consequential. Thus, the relationship between comparative risk estimates and precautionary behavior may depend on dispositional optimism only to the extent that the consequences associated with the failure to take action are minimal.

## Limitations

The present research moves us considerably beyond past research examining the relationship between relative risk and precautionary behavior. First, it examined the different functions of both comparative and non-comparative risk perceptions. Second, whereas past research measured

perceived risk and precautionary behavior concurrently, the present research employed a longitudinal design. Despite the advantages of using a longitudinal design, the greatest limitation of the present study is that it still battles same interpretational ambiguities inherent in correlational research. Specifically, I cannot conclude a causal relationship between perceived risk estimates and precautionary behavior.

Because of these limitations, future research should focus on experimentally testing the relationship between perceived risk and precautionary behavior. In addition, this relationship should be examined with regard to a wide range of health risks. The present research investigated the impact of perceived risk on precautionary contraceptive behavior and this relationship may vary for different health risks.

## CONCLUSIONS

Researchers study the optimistic bias because they believe that an overly rosy view of the future may contribute to mental and physical harm. The present research finds no evidence that the optimistic bias is harmful; rather, the data suggest that being optimistically biased may actually promote mental well-being. One might conclude from these findings that the greater the optimistic bias, the greater the mental and physical benefits. However, we are all familiar with the old adage cautioning that, "too much of a good thing can be bad." Taken in the present context, although a moderate optimistic bias appears have its benefits, unbridled optimism undoubtedly has its costs. Thus, the more appropriate conclusion might be, "moderation is key."

APPENDIX A
SELF-REPORTED BEHAVIOR MEASURE

**Note:** For the following questions please consider only sexual intercourse that was engaged in by two consenting persons of the opposite sex. (That is, do not include rape, incest or other non-consensual sexual activities).

How many times have you had sexual intercourse in the last 6 months? ____ times

Which birth control method(s) have you used over the past 6 months? (IMPORTANT: Please make sure the numbers you supply for this question add up to the total number of times you have had intercourse in the last 6 months.)

____ none

____ condom

____ withdrawal before ejaculation

____ birth control pills

____ intrauterine device (IUD)

____ spermicide

____ rhythm method

____ diaphragm

____ intuitive feeling about what is a "safe" time

____ other _____

APPENDIX B
MILLER-FISK SEXUAL KNOWLEDGE SCALE

For each item, circle the answer you think is correct.

1. The single most important factor in achieving pregnancy is:
   a. time of exposure in the cycle
   b. female's desire or wish to become pregnant
   c. frequency of intercourse
   d. female's overall state of health

2.Which of the following is the most dependable (effective) method of contraception or birth control:
   a. condom
   b. diaphragm plus jelly or cream
   c. rhythm method
   d. pill

3. Following release from the ovary the human ovum (egg) is capable of being fertilized for:
   a. 6 to 12 hours
   b. 24 hours
   c. 48 hours
   d. 4 to 6 days

4. A good index of a female's relative fertility (ability to achieve pregnancy) is:
   a. her overall health
   b. the regularity of her periods
   c. the level of intensity of her sex drive
   d. her ability to achieve orgasm

5. Which of the following methods of contraception is the most effective:
   a. condom
   b. rhythm
   c. diaphragm plus jelly or cream
   d. intrauterine device

6. The normal female most often ovulates (gives off egg):
   a. 2 weeks before the onset of menstruation
   b. just prior to menstruation
   c. immediately following menstruation
   d. at unpredictable times throughout the cycle

7. Infertility (inability to achieve pregnancy) is:
   a. familial or inherited
   b. a male problem in one-third of cases
   c. a female problem in 90% of the cases
   d. easily diagnosed after six months of marriage

8. Which of the following is the poorest or least dependable form of contraception:
   a. condom
   b. diaphragm
   c. post-intercourse douching
   d. rhythm

9. A normal human ovum (egg) is approximately the same size as:
   a. a pinhead
   b. a small pearl
   c. a dime
   d. none of the above

10. Fertilization (union of sperm and egg) normally occurs in which of the following anatomical locations:
   a. the uterus (womb)
   b. the cervix ( mouth of the womb)
   c. the tube
   d. the vagina

11. Menopause is a time of:
   a. diminished sexual desire
   b. absolute infertility
   c. rapid aging
   d. altered reproductive and menstrual functioning

12. The rhythm method of contraception is
   a. always effective
   b. avoidance of intercourse at unsafe times
   c. a technique of intercourse
   d. none of the above

13. Pregnancy would be impossible in early adolescence when menstruation has not yet even begun.

   a. true
   b. false

14. Menstrual blood is similar to a body "poison" or toxin that must be eliminated in order for a woman to remain healthy.

a. true b. false

15. A woman who begins to menstruate on the first Wednesday of every month is "as regular as a clock".

a. true b. false

16. In order to have a normal period there must be a moderate to heavy flow in terms of amount of blood and/or duration of flow.

a. true b. false

17. The loss of one ovary through disease or surgery diminishes a woman's fertility little if at all.

a. true b. false

18. Anatomical differences (i.e. size, shape, capacity, etc.) of the genital organs has a great bearing on sexual compatibility or satisfaction.

a. true b. false

19. Unplanned or undesired pregnancies have a greater likelihood of miscarrying than do planned pregnancies.

a. true b. false

20. Failure to have an orgasm on the part of the female eliminates or substantially reduces the likelihood of becoming pregnant.

a. true b. false

21. Withdrawal is an effective means of contraception (birth control).

a. true b. false

22. Birth control pills directly increase the sex drive (desire) in most women.

a. true b. false

23. Sperm retain their ability to fertilize (cause pregnancy) for one or two days following ejaculation.

a. true b. false

24. Most women are more fertile during one particular season of the year than another.

a. true b. false

APPENDIX C
STATE TRAIT ANXIETY MEASURE

DIRECTIONS: A number of statements which people have used to describe themselves is given below. Read each statement and report how you feel *right now, at this moment.* There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm.*
2. I feel secure.*
3. I am tense.
4. I am regretful.
5. I feel at ease.*
6. I feel upset.
7. I am presently worrying over possible misfortunes.
8. I am rested.*
9. I feel anxious.
10. I feel comfortable.*
11. I feel self-confident.*
12. I feel nervous.
13. I am jittery.
14. I feel "high strung".
15. I am relaxed.*
16. I feel content.*
17. I am worried
18. I feel over-excited and rattled.
19. I feel joyful.*
20. I feel pleasant.*

*indicates a reverse scored item.

APPENDIX D
PAST EXPERIENCE MEASURE

Have you ever had an unplanned pregnancy? ____ Yes _____ No

If yes, when? _____

Has a close friend ever had an unplanned pregnancy? _____ Yes _____No

If yes, when? _____

Have you ever had a sexually transmitted disease (such as chlamydia, herpes, or gonorrhea)?

_____ Yes _____No _____Not sure

If yes, when? _____

Has a close friend ever had a sexually transmitted disease?

_____ Yes _____No _____Not sure

If yes, when? _____

APPENDIX E
THE LIFE ORIENTATION TASK

Choose a number on a scale below that best represents your feelings about each statement. Please be as accurate and honest as you can and try not to let your answer to one question influence the answers to other questions.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |

_____ 1. In uncertain times, I usually expect the best.

_____ 2. If something can go wrong for me, it will.

_____ 3. I always look on the bright side of things.

_____ 4. I'm always optimistic about my future.

_____ 5. I hardly ever expect things to go my way.

_____ 6. Things never work out the way I want them to.

_____ 7. I'm a believer in the idea that "every cloud has a silver lining."

_____ 8. I rarely count on good things happening to me.

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Cynthia Taylor Findley was born on October 21, 1971, in Arlington Heights, Illinois. She completed her Bachelor of Arts degree in Psychology at Texas A & M University in College Station, Texas, in May of 1993. In August of 1993, Cynthia began her graduate studies at the University of Florida in social psychology. Under the supervision of Donna Webster, she completed her Master of Science degree in social psychology at the University of Florida in Gainesville, Florida, in May of 1996. The topic of her master's thesis was individual differences in argument scrutiny as motivated by the need for cognitive closure. Also in the May of 1996, she married David Klein and changed her name to Cynthia Taylor Findley-Klein. Under the supervision of James Shepperd, she completed her doctor of Philosophy in social psychology at the University of Florida in Gainesville, Florida, in August of 1999. The topic of her doctoral dissertation was the relationship between the optimistic bias and future precautionary behavior.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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